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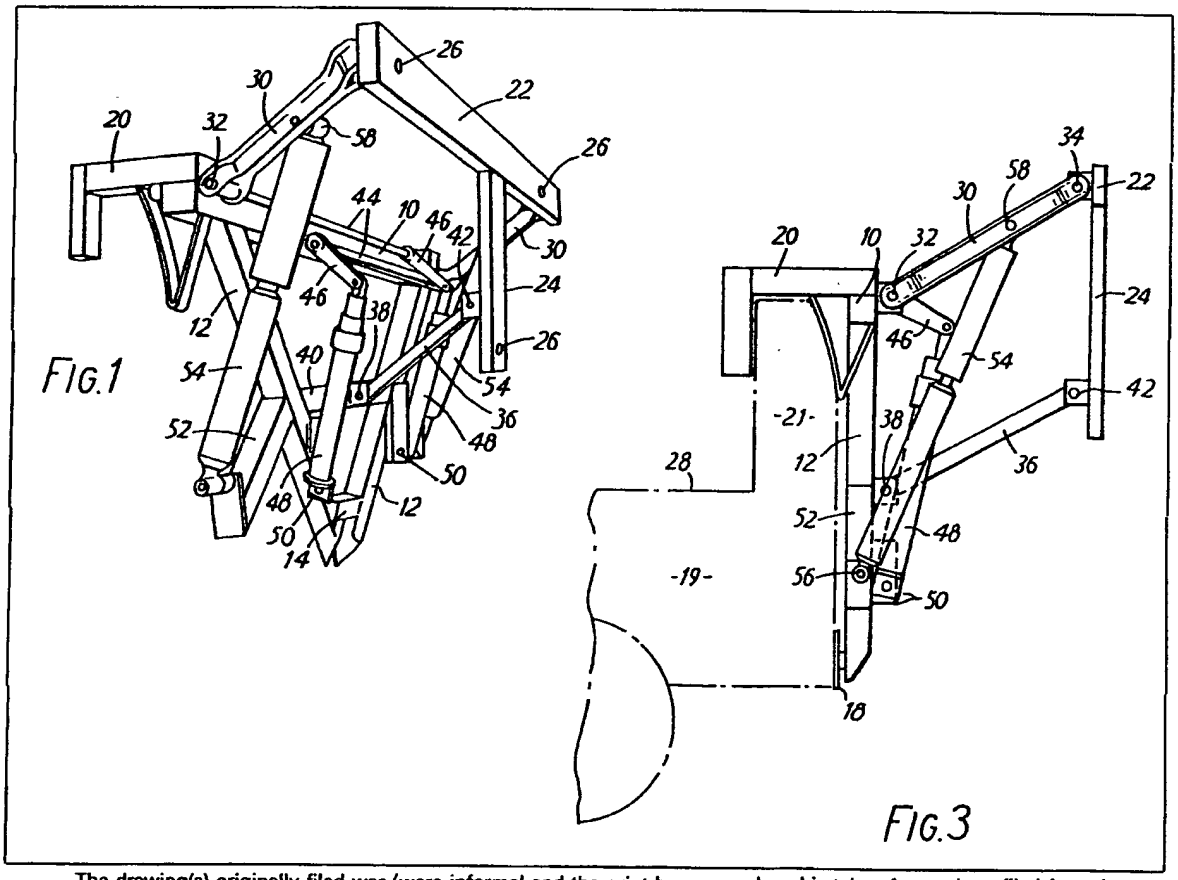
(54) Support for crop spraying boom

(57) A supporting device for a crop spraying boom has a hooked harness 20 for fitting over the tailgate of a pick-up truck. A vertical boom supporting member 22,24 is mounted to a frame 10,12 by two upper pivoting link members 30 and a lower pivoting link member 36, forming a parallelogram linkage. To absorb vertical motion of the boom, hydraulic shock absorbers 54 and torsion bars 44 are connected to the link members 30. Hydraulic rams 48 can rotate the torsion bars 44 to raise and lower the boom.



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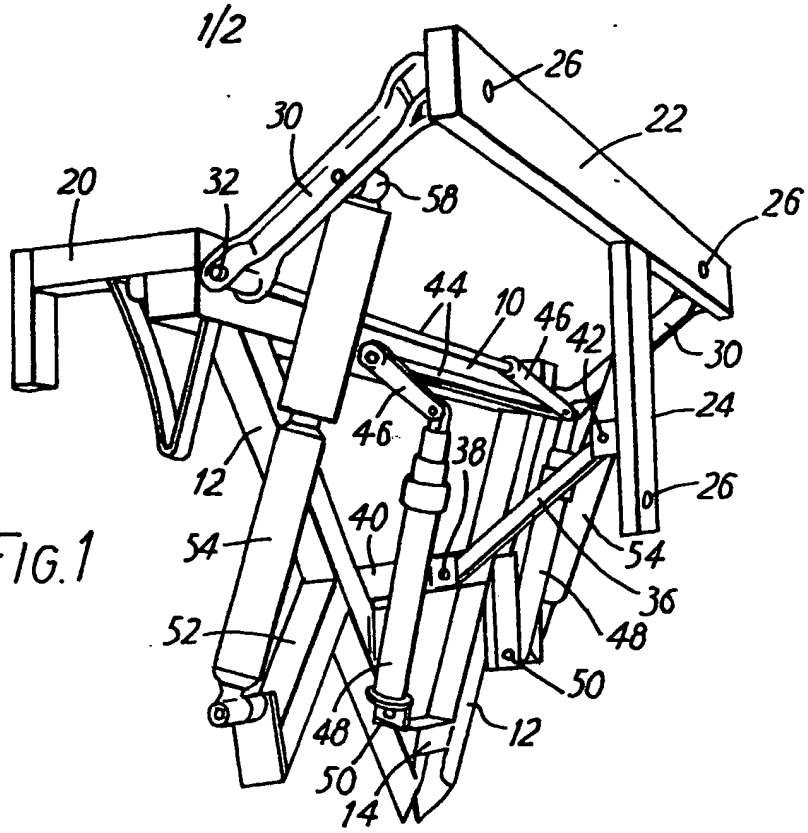
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FIG.1

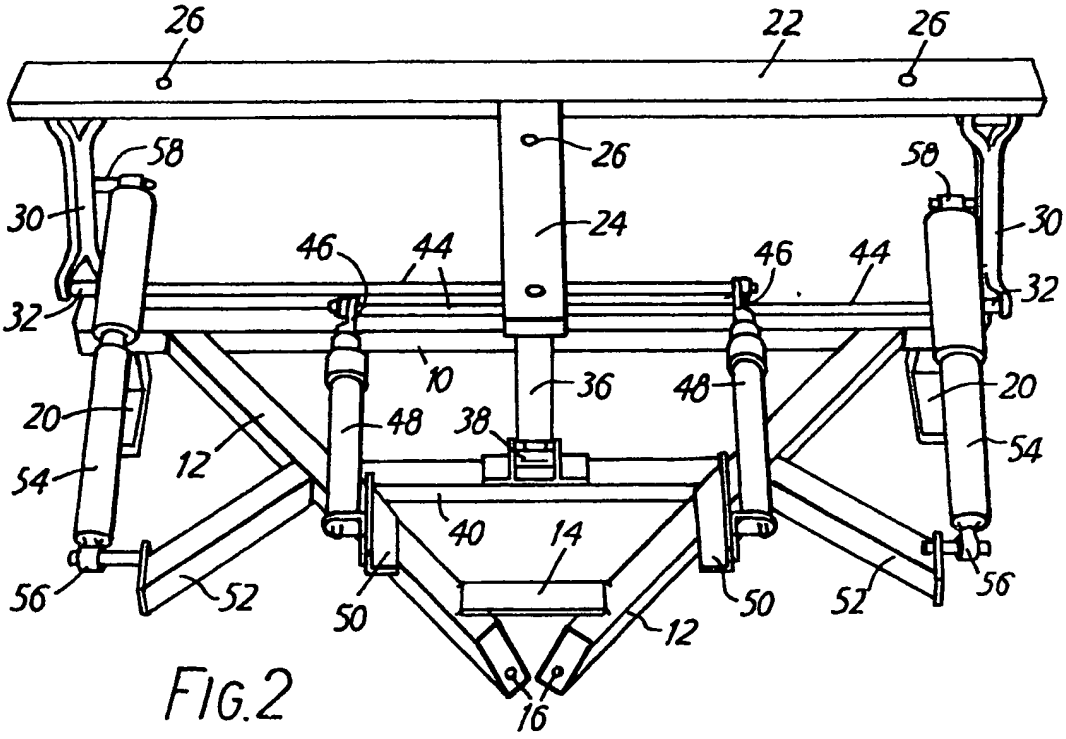
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FIG.2

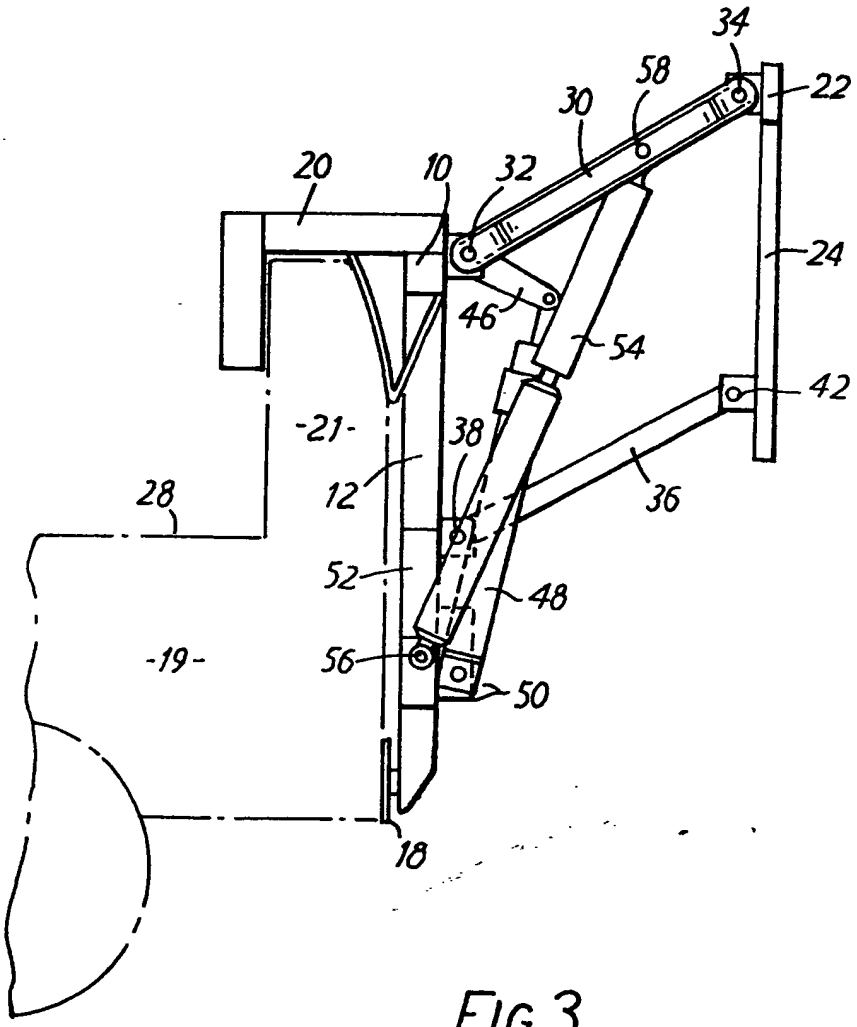

FIG.3

SPECIFICATION

Crop sprayer

This invention relates to a crop sprayer.

Known crop sprayers comprise a generally horizontal boom which is arranged to extend laterally at the back of a vehicle such as a tractor or truck, or at the back of a trailer for towing by such a vehicle. Liquid such as a suitably diluted pesticide is pumped through the boom, and is sprayed on to the ground through spray nozzles arranged at regular intervals along the boom.

It is important for effective spraying that the amount of liquid delivered per unit area of ground should be accurately controlled. Too little delivery will be ineffective, whereas too much could well be fatal to the crop. A problem arises here owing to the fact that the boom is often as long as 12 meters in order to cover as much ground as possible on each sweep and make spraying a field as quick a job as possible. It is inevitable that a boom so long will be resilient. Consequently, as the vehicle or trailer on which it is fitted goes over bumps in the ground (for example caused by ploughed furrows from previous years) not only will the most central spray nozzles on the boom be at different heights from the ground, but those at the extremities will move even further because of the oscillation which will be set up in the boom. With the spray nozzles at different heights on different parts of the field, this will result in uneven spraying, often in a striped pattern which can later manifest itself in the growing crop.

Previous approaches to this problem have been to provide so-called "self-levelling" booms. These aim to keep the boom horizontal at all times, even if one wheel of the trailer or tractor should go over a bump while the other does not. For example, in one known crop sprayer a boom is pivotally mounted and its centre of gravity is continually adjusted so as to keep the boom horizontal. Another type of boom has a "trapeze" mounting allowing the boom to yawl with respect to the tractor or trailer, and thus to stay horizontal.

A disadvantage with such self-levelling booms is that they do not prevent oscillation when both rear wheels of the vehicle or trailer pass over a bump simultaneously, for example caused by a furrow from a previous year. Moreover, they only work while on horizontal ground. When spraying on a slope, since the boom will be kept h riz ntal on nd of it will be closer to th ground than th oth r, which again giv s an uneven spraying. Furthermor , on anything m re than a very gentl sl p the ends of the boom will t nd to catch on the ground, thus rendering th crop sprayer useless on such slop s.

The pr sent invention provides a supporting device for a cr p spraying boom, comprising a frame for attachm nt to a v hicle or trailer or forming part th r of, a boom supporting member, and at least two link members which are generally parallel to ach other and which are pivotally connected at one end to the frame and at the other end to the boom supporting member so that the frame, the boom supporting member and the two link members form a parallelogram linkage which permits generally vertical motion of the boom supporting member relative to the frame, and motion absorbing suspension means connected between a point fixed relative to the frame and a point movable together with the boom supporting member. Motion of the frame member, e.g. caused by bumps, can then be at least partially absorbed, rather than being passed to the boom.

The suspension means may include one or more conventional hydraulic shock absorbers or dampers. Additionally or alternatively, one of the link members may be secured at its pivotal connection with the frame to a torsion bar, the other end of which may be normally held relatively rigid, and which may be secured to a crank. In the latter case, turning the crank will rotate the torsion bar about its axis, thereby causing pivoting of the link member to move the boom supporting member to a desired position. The crank may be turned by a hydraulic ram.

Preferably, there are three generally parallel link members rather than two, and these may be pivoted at points on the frame defining a triangle, in order to increase the stability of the parallelogram linkage. In a preferred arrangement, the frame member and the boom supporting member are in mutually spaced generally vertical planes, and two link members are laterally spaced from each other while a third is vertically spaced from the other two and arranged laterally in between them. The two laterally spaced link members may both be provided with hydraulic dampers or shock absorbers, and may both be provided with a said torsion bar and with a crank and hydraulic ram for raising and lowering the boom supporting member.

A preferred embodiment of the invention will now be described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a perspective view of a supporting device for a crop spraying boom,

Figure 2 is a perspective view of the device from behind and beneath, and

Figure 3 is a sid vi w of th device.

R ferring to the drawings, the d vic includ s a generally triangular fram c mprising an upper horizontal bar 10 and two g n rally diagonal bars 12 which are held together at the bottom by a plate 14. The frame is arranged in a generally v rtical plane in use. The bottom ends of th bars 12 hav hol s 16 which, as shown in Fig. 3, can be used to

secur it to a mounting plat 18 on a vehicle 19, such as is normally used for a ball hitch. At ach nd of the horizontal ber 10, there is a harness 20 for hooking over the tailgate 21 of a vehicle 19 of the pick-up truck variety. However, it will be appreciated that such mountings 18,20 are not essential, and any other kind of mounting may be used to suit the device for mounting on a vehicle such as a tractor, or a trailor for pulling behind another vehicle.

A T-shaped boom supporting member comprises a horizontal bar 22 and a depending, vertical bar 24. These are provided with holes 26, as required, by means of which any conventional crop spraying boom may be attached, together with its control valves, etc. In use, a tank of a liquid to be sprayed on a crop will be carried in the load compartment 28 of the pick-up truck, together with a suitable pump, and connected to the crop spraying boom by flexible hoses.

An upper link member 30 is pivoted at 32 to each end of the bar 10, so that the two link members 30 are laterally spaced. The other ends of the link members 30 are similarly pivoted at 34 to respective ends of the horizontal bar 22 of the boom supporting member. Vertically spaced from the two upper link members 30, there is a lower link member 36 of a similar length. This is pivoted at one end 38 to a cross member 40 extending between the two frame members 12, and at the other end 42 to the vertical bar 24 of the boom supporting member. As best seen in Fig. 3, the frame members 10,12, the boom supporting members 22,24, the upper link members 30 and the lower link member 36 thus form a parallelogram linkage, allowing the boom supporting member to be raised and lowered relative to the frame members. The boom supporting member is held in a generally vertical plane while this happens, so that the spray nozzles on the boom (when fitted) will always point directly down to the ground, even if movement is induced in the boom owing to the vehicle passing over bumps in use. Moreover, the use of the two laterally spaced upper link members 30 ensures that the boom cannot twist about a fore-and-aft axis, but always remains parallel to the ground over which the vehicle is passing.

The ends 32 of each upper link member 30 are rigidly secured to one end of a respective torsion bar 44. The opposite ends of the torsion bars 44 are pivotally mounted and rigidly secured to resp ctiv cranks 46. Two hydraulic rams 48 are pivotally secured at one end to brackets 50 on the diagonal frame members 12, and at the other end to respectiv cranks 46.

In use, the hydraulic rams 48 are controlled in unison from the hydraulic supply of the vehicle to which the devic is fitted. As the rams are extended, the torsion bars 44 are rotated about their axes by the cranks 46, and this causes the link members 30 to raise the boom supporting m mbers 22,24 (whil still keeping it vertical b cause of th parallelogram linkage). Conversely, retracting the rams will lower the boom supporting member.

When the boom supporting member has been raised or lowered to a desired spraying height, it will be held in position through the torsion bars 44 by the rams 48. However, it will not be rigidly held in position, because the torsional resilience of the torsion bars 44 will permit it to move up and down slightly. The purpose of this is that when the vehicle to which the device is fitted travels over a bump in the ground, a fair proportion of the vertical motion of the vehicle caused by the bump will be absorbed by the torsional resilience of the torsion bars 44, and not transmitted to the spraying boom, because of the inertia of the latter. It follows that when the vehicle is travelling over bumpy ground, the boom will stay at a more fixed spacing from the ground than might otherwise be expected, and the density of spraying will be more even.

Each diagonal frame member 12 is provided with a diagonal, laterally extending arm 52. To the free ends of this arm 52 there is pivotally mounted at 56 a conventional hydraulically damped shock absorber 54. The other end of each shock absorber is taken to a pivot point 58 on a respective upper link member 30. The shock absorbers 54 therefore damp out and help to absorb the motion of the parallelegram linkage, and thus cooperate with the torsion bars 44 to provide a smooth suspension for the crop spraying boom. It will be appreciated that the shock absorbers 54 could if desired be pivoted directly to the boom supporting members 22,24.

Accordingly, in contrast to prior art self-levelling booms, there is provided a system in which the boom is not maintained generally horizontal, but rather is maintained parallel to the ground and any motion caused by the vehicle passing over bumps in the ground is substantially absorbed rather than being transmitted to the boom. As a result, we have found it possible to spray crops on the ground where this would be difficult with the conventional booms, and on more moderate terrain to spray at speed of up to 22 miles an hour (about 35 km per hour), rather than the much slower speeds (around 8 miles an hour or 13 km per hour) necessary with the known crop sprayers.

Instead of two upper link members 30 and a single lower link member 36, th arrangement could be reversed, so that there are two lower link m mbers with torsion bars and a single upper link member.

A further possible modification is to use a different torsional arrangement instead of the torsion bars 44. F r example, a torsional coil

spring, attached at one end to a crank like the cranks 46 and at the other end to the link m mber 30 could be used in place of each torsi n bar 44, operating in the same manner. Fixed shafts are then fitted co-axially inside the springs where the torsion bars are in the embodiment described above, to hold the springs in place.

CLAIMS:

1. A supporting device for a crop spraying boom, comprising a frame for attachment to a vehicle or trailer or forming part thereof, a boom supporting member, and at least two link members which are generally parallel to each other and which are pivotally connected at one end to the frame and at the other end to the boom supporting member so that the frame, the boom supporting member and the two link members form a parallelogram linkage which permits generally vertical motion of the boom supporting member relative to the frame, and motion absorbing suspension means connected between a point fixed relative to the frame and a point movable together with the boom supporting member.

2. A device according to claim1 wherein the suspension means includes one or more hydraulic shock absorbers or dampers.

3. A device according to claim 1 or claim 2 wherein the suspension means includes a torsion bar, one of the link members being secured at its pivotal connection with the frame to one end of the torsion bar, the other end of the torsion bar being normally held relatively rigid.

4. A device according to claim 3 wherein said other end of the torsion bar is secured to a crank which when turned causes rotation of the torsion bar and pivoting of said link member to move the boom supporting member.

5. A device according to claim 4 including a hydraulic ram arranged to turn the crank.

6. A device according to any preceding claim having three generally parallel link members, pivoted at points on the frame defining a triangle.

7. A device according to claim 3, 4 or 5 having three generally parallel link members, pivoted at points on the frame defining a triangle, two of said link members being secured at their pivotal connections with the frame to respective said torsion bars.

8. A device according to claim 6 or 7 wherein the frame member and the boom supporting member are in mutually generally vertical planes, and two of the link members are laterally spaced from each other while the third is vertically spaced from the other two and arranged laterally between th m

9. a d vice according t claim 8 wherein said third link member is above the other two.

10. A d vic according to claim 8 wher in said third link m mber is below the oth r two.

11. A device according to claim 8, 9 or 10 wh rein said suspension means is connected to said two of the link members which ar vertically spaced from the third.

12. A device according to any preceding claim adapted to hook over a vehicle tailgate.

13. A device according to claim 9 and substantially as described herein.

14. A supporting device for a crop spraying boom, substantially as described herein with reference to the accompanying drawings.

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